DRYING NEEDS: THE SIERRA LEONEAN FARMERS' PERCEPTION

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ABSTRACT

The development of improved drying systems for use in rural areas usually takes place without adequate prior knowledge of the drying problems being experienced by farmers, which has lead to the poor acceptance of several of these systems. This paper presents the results of a study carried out in Sierra Leone to obtain farmers' views of their drying needs and problems. Formal and informal surveys were conducted amongst about 700 farmers to determine; the types of crops grown that needed drying, areas cultivated, quantities of crops harvested and dried, disadvantages and advantages of traditional methods, farmer's willingness to pay for improved drying systems, etc. Results indicate that a wide range of types and quantities of crops is traditionally dried (during both wet and dry seasons) before storage for, on-farm consumption, the local market and export. Most farmers feel that they have significant losses due to inadequate drying methods, they wish to improve their drying practices and are in general willing to pay for improved drying systems provided the cost is low. The results of the study have been used to develop a scenario for the development of solar dryers in Sierra Leone, outlining the type of systems and conditions under which they should be introduced.

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INTRODUCTION

Rural dwellers need to dry their harvest inorder to lower the crops' moisture contents for better storage or to preserve the crops before sale. Although traditional drying gives satisfactory products, it has several disadvantages such as losses caused by, rewetting by rain, dust, insect infestation, rodent and bird attack, wind, vandalism, theft and overdrying. In many cases, traditional open air sun drying is difficult to achieve due to the high relative humidities of the ambient air.

Despite the recognized need for improvements to traditional drying, with respect to increasing the quantity and improving the quality of crops in storage, farmers have not generally responded positively to the introduction of improved drying systems. This failure in getting farmers to accept suggested improvements is partly related to a prior lack of knowledge (on the part of development workers/researchers) of the farmers' real perception of their drying needs. The "feelings" of these potential users should be known, whether they are justified or not, for it is through such knowledge can satisfactory interaction take place, causing them to accept improved drying systems.

This study was therefore carried out in Sierra Leone (in the absence of any previous studies on crop drying needs), to determine how farmers in that country perceived their drying needs, to assess the scope of associated problems and to determine their willingness to accept change. It was also intended to use the information obtained to suggest possible future interventions for improving traditional drying.

DESCRIPTION OF SURVEY METHODS

Formulation of Questionnaire

A simple questionnaire was developed to obtain information on: farmers' personal data; size of farms, types and quantity of crops harvested and dried; farmers' views on the merits of, and losses associated with, traditional drying methods; farmers' willingness to change traditional drying methods and to pay for changes; and, how farmers disposed of dried crops. Most of the questions were subjective since the aim of the study was to obtain farmers' views on, and reactions to their drying problems.

Choice of Survey Locations

Survey areas covered seven Districts (shown in Figure 1) in three active agricultural provinces in Sierra Leone, where crops are grown for both local consumption and export. Farms visited were chosen based on accessibility by local transport. No attempt was made to choose any specific type or size of farm. The number of farms surveyed was limited by manpower resources and transportation facilities.

Execution of Survey

Enumerators were trained to use the questionnaires and to hold casual conversations with farmers in order to obtain information relevant to the survey which was executed over a period of two months. All enumerators spoke the languages of the areas to which they were assigned. A total of 682 farmers were interviewed. Responses obtained were checked in the field by holding informal conversations with some farmers, randomly chosen from the larger sample. (These checks were found to match well with the formal survey data).

RESULTS AND DISCUSSIONS

Crops Surveyed

The percentage of farmers cultivating various crops that need drying are shown in Figure 2. Although the range of crops presented do not represent all of the crops dried in Sierra Leone, they give a good indication of their relative importance. The majority of the crops shown in Figure 2 leave the farms in the dry state, exceptions being pepper, groundnuts, maize and cassava. The percentage of farmers indicating the state in which these crops leave their farms are: pepper - 44% dried, 56% raw; groundnuts - 68% dried, 23% raw; maize - 66% dried, 35% raw.

Rice is the staple food in Sierra Leone. Coffee, cacao, ginger, and piassava are grown mainly for export. The rest of the crops are for local consumption.

The sizes of farms cultivated by various farmers are illustrated in Figure 3 for some crops. Results indicate that rice, coffee and cacao are cultivated on the largest areas of land, this being expected, considering the important role of rice as a staple and the other crops as foreign exchange earners. Most of the other crops (not shown) are farmed on small areas of about 3 acres. Since mixed cropping is practiced extensively by farmers, it is noted that areas farmed for each crop are generally smaller than those indicated. In general, the area of farms cover a wide range for each crop.

The crops are harvested at various times of the year as shown in Table 1. Given that the wet and dry seasons last from May-September and October-April respectively, it is noted that rice, maize, pepper, groundnuts and cacao are harvested during the rainy season. The high relative humidity of the ambient air (80-100%) and low levels of solar radiation (10-15 MJ/m2/day) (Bassey 1982), make it difficult to dry the crops in the open air during the rainy season.

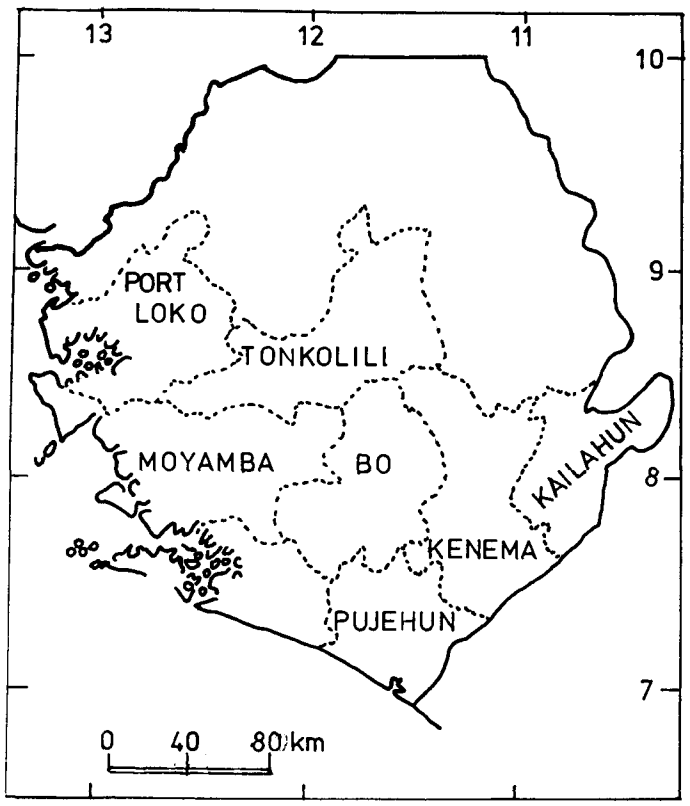

Figure 1. Location of the seven districts where survey was carried out.

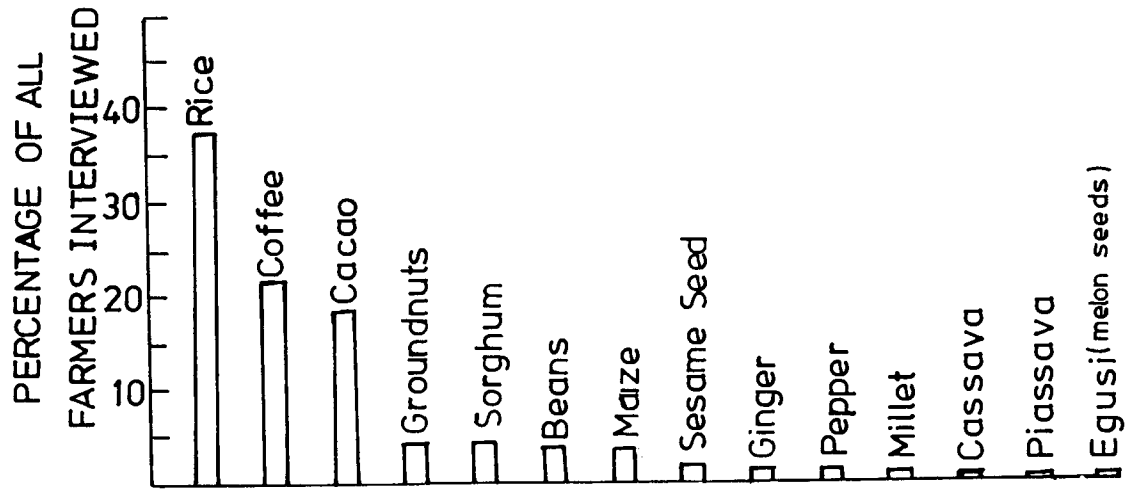

Figure 2. Percentage of all farmers interviewed who cultivate a given crop.

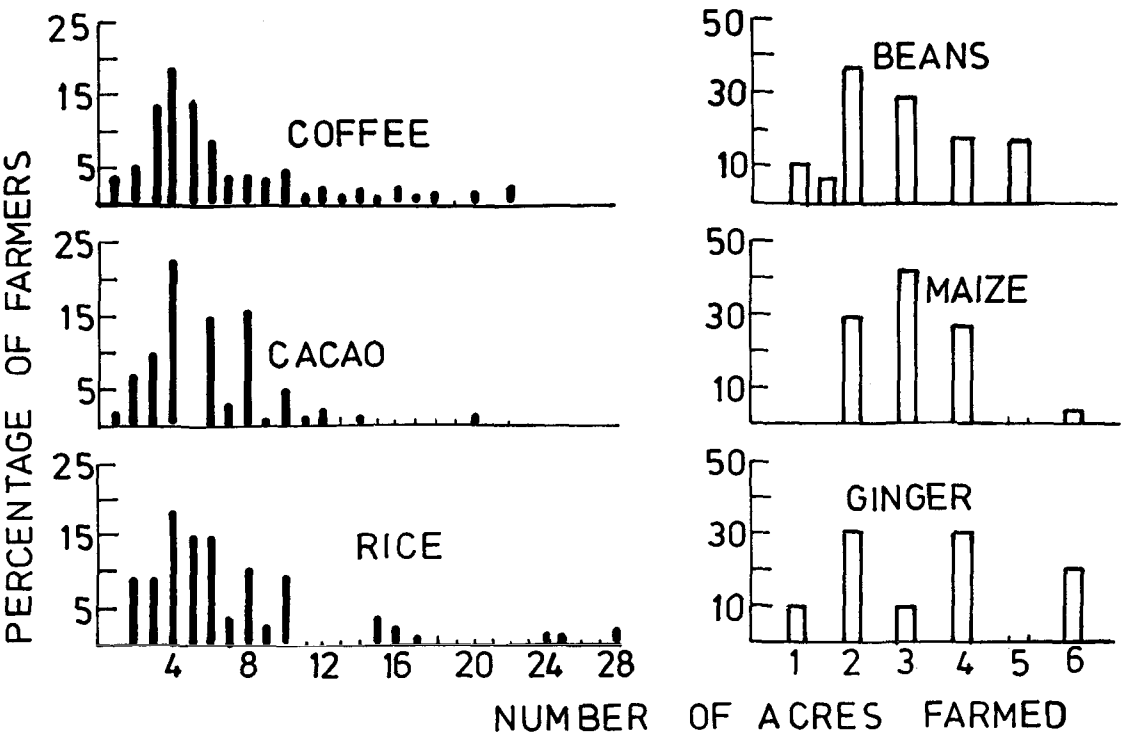

Figure 3. Percentage of farmers, of the total for each crop, cultivating various areas of land.

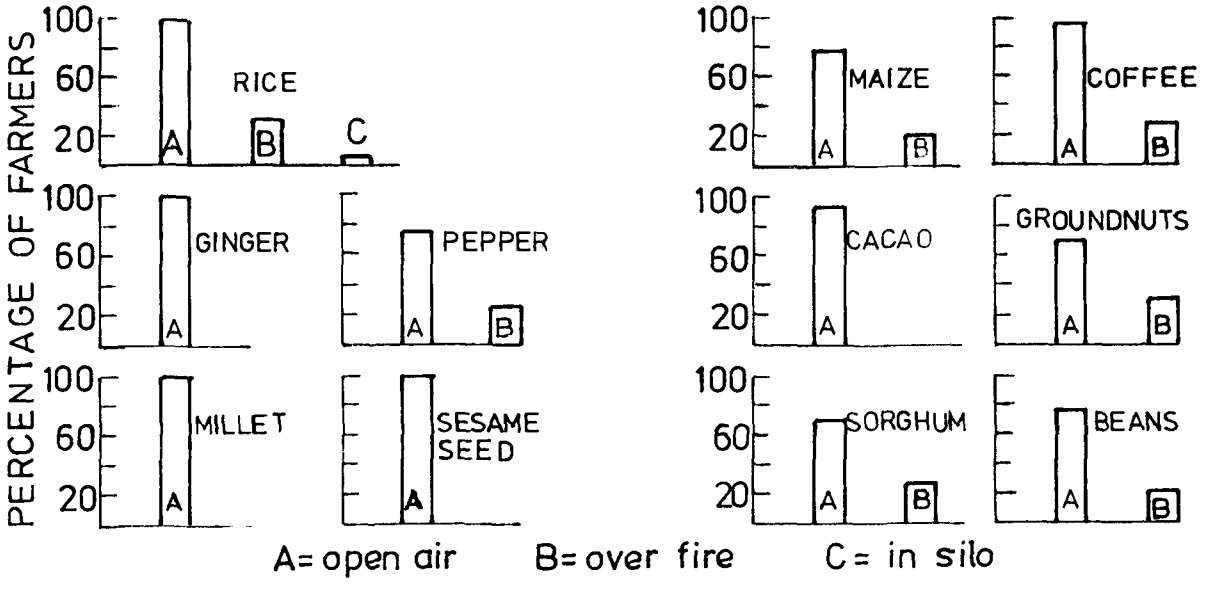

Figure 4. Percentage of farmers, of the total for each crop, using various drying methods.

Table 1. Period of harvest for various crops in Sierra Leone.

Crops	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May
Rice			----	----	----	----	----					
Coffee					----	----	----					
Cacao		----	----	----	----	----	----	----	----	----		
Groundnuts	----	----	----									
Millet			----	----								
Pepper	----	----	----									
Ginger							----					
Maize		----										
Sorghum					----	----						
Sesame Seed					----							

Methods of Drying Crops

Farmers interviewed described two methods of drying their crops; in the open air and over a fire. The former is achieved by spreading the crop thinly on the ground or on cement floors outdoors and the latter done by heating the crop in a pan over fire or stacking the unthreshed crop in the attic of a hut and allowing the heat from a fire to slowly dry it by natural convection. Results in Figure 4 show that open air drying is the predominant method used, with the exception of ginger. A small percentage of farmers store rice in traditional bins where it undergoes drying.

Quantities Dried and Duration of Drying

Quantities of crops dried by farmers at any time are shown in Figure 5, noting that one bushel is equivalent to a volume of about 36 litres. For each crop, various quantities are dried, due to the wide range of areas cultivated as shown in Figure 3. This wide distribution of quantities of crops dried has certain significance for suggested improvements which will be discussed later.

The wide range of drying times as perceived by farmers (Figure 6) is interesting. For a given crop, differences in drying times reported by farmers can be partially attributed to the differences in farming and post-harvest practices. For example, in the case of rice, some farmers leave it unharvested to achieve partial drying and then stacking the harvested rice in the field over several days for further drying. Other farmers harvest earlier and dry the threshed rice in the open air, or store it unthreshed in their attic for further drying. Each farmer would thus have a different perception of the duration of drying, as reflected in the results shown.

The above results indicate the complexity of trying to improve drying based on the information obtained from survey results in general. In practice, an understanding has to be reached regarding what is reality and what is the farmers' personal view. Even though they may not be accurate in their interpretation of a given situation, their viewpoint must be understood in order to present them with factual information that is required to influence their conclusions concerning the performance of an improved drying system, compared to those used traditionally. Comparison between traditional and improved drying systems should thus take place after clearly specifying the physical state of the harvested crop (maturity and moisture content), inorder to have a common starting point. It may be necessary for farmers to modify their farming practices inorder to effectively use suggested inprovements. (The majority of farmers are willing to change their harvesting practices if crop losses can be reduced.)

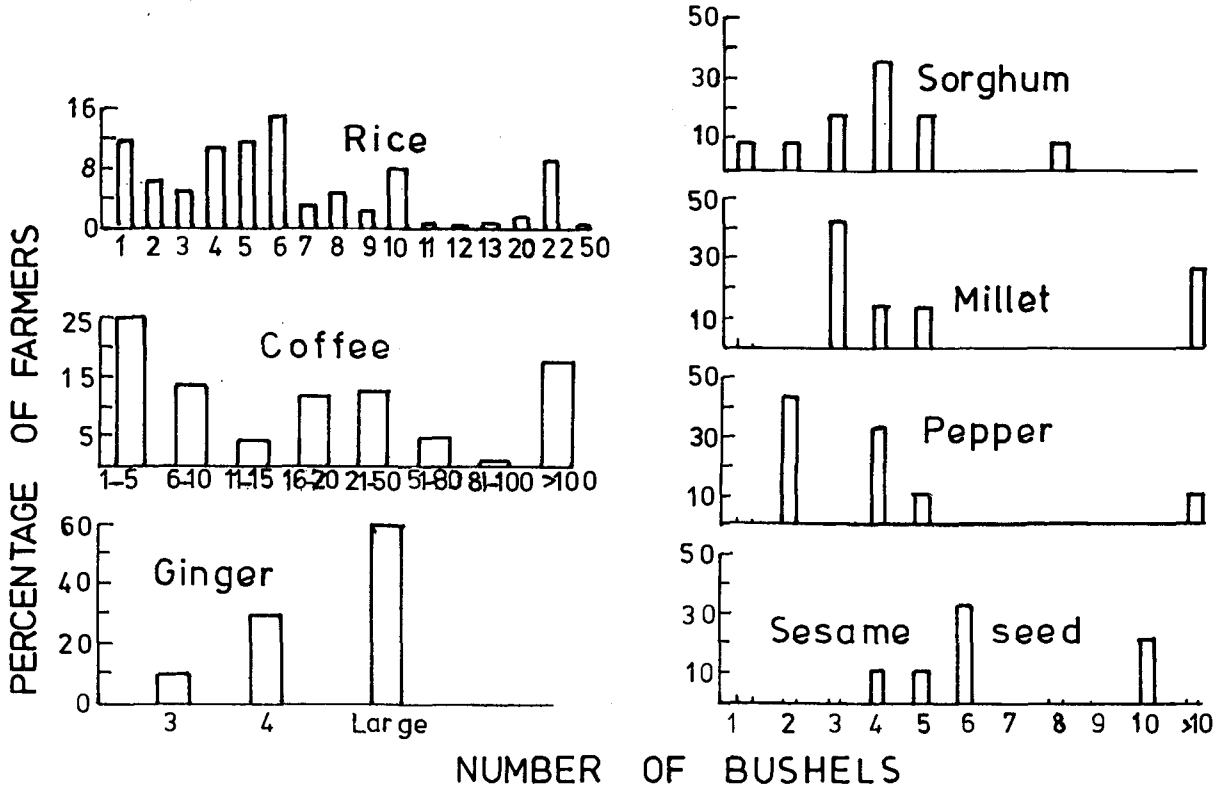

Figure 5. Percentage of farmers, of the total for each crop, drying various quantities of crops at the same time.

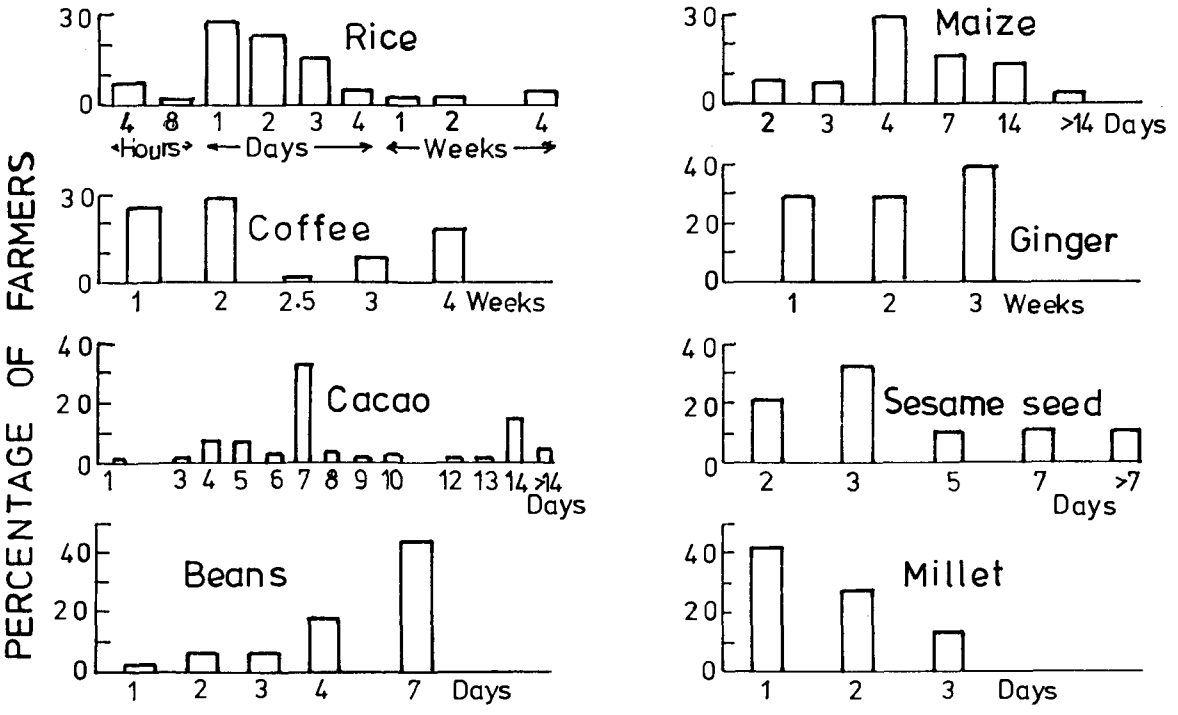

Figure 6. Percentage of farmers, of the total for each crop, indicating duration of drying.

Advantages and Disadvantages of Traditional Drying

The views of farmers regarding the advantages and disadvantages of drying in the open air and over fire are shown in Tables 2 and 3. (Instances where farmers are not sure of an answer or the particular question is not applicable are left as a blank in the tables.)

Farmers practising open air drying (Table 2) do not generally feel that the method is fast enough. However they feel that the quality of the dried crops is good and that open air drying permits them to dry large quantities. It is difficult to conclude whether farmers perceive open air drying as being low cost. It is the author's opinion that farmers are unable to make any accurate judgement about the cost of traditional drying as they do not have any other method with which to compare.

The majority of farmers feel that traditional drying has disadvantages as shown in Table 2, due to insect infestation, losses due to wind, rain, mold formation, and long drying periods. It is noticed that even though a crop may have poor quality due to some of the latter mentioned factors farmers may feel satisfied about the quality.

Farmers do not generally feel that "over fire" drying is advantageous; it is a slow process and large quantities cannot be stored in attics due to their inadequate structural design. Disadvantages are considered low since the crops are protected from rain, dust, wind and animals, and the smoke and heat maintains them at safe moisture contents which helps to reduce insect infestation. However rodents cause significant losses in these storage structures. Crops burnt are those that are dried in pans over a fire.

Losses During Drying

The maximum drying loss as perceived by farmers are shown in Figure 7. While these figures may not give exact values of losses, they do reflect the views of farmers who carry out the activities and at least indicate the importance attached to losses for each crop. Considering the small areas cultivated these losses are significant.

Of all the crops, the highest perceived losses are for rice. This important crop undergoes drying in fields and near the farmers house. Results of ongoing work in Sierra Leone shows that losses of up to 10% may occur during traditional drying (Koroma 1987). Losses cited for the other crops are expected to be realistic but they need to be confirmed by more thorough loss assessment studies.

Willingness To Pay For Improved Drying Methods

Although farmers find their present drying methods satisfactory, they wish to have improvements for which the majority (about 80%) are willing to pay (see Figures 8 and 9). (It should be noted that due to the economic conditions in Sierra Leone costs have increased by a factor of about 10, suggesting that the amounts shown are not now realistic. They however indicate relative investments farmers are willing to make.) The wide range of amounts farmers for each crop are willing to pay for a dryer (Figure 8) is due to the differences in farm sizes, and the resulting differences in economic levels of the farmers. About 45% of farmers expressing willingness to pay for improvements are able to invest realistic amounts (above 50 leones at the time of the survey) that will enable them to procure a dryer (Figure 9).

The number of farmers unsure regarding amounts they can afford for dryers (Figure 8) is significant for each crop and is considered as an unwillingness to pay for such an improvement in drying. These farmers are those with the lowest production levels; they use most of their harvest for home consumption (over 40% of farmers for each crop as shown in Table 4) and may not see the necessity of investing their scarce resources to improve drying. In the case of ginger, the high

TABLE 2: Percentage of farmers, for each crop, expressing advantages and disadvantages of open air drying

Crop	ADVANTAGES				DISADVANTAGES				
	Fast Drying	Good Quality	Dry Larger Quantities	Cost Low	Insect Infestation	Rain, Wind Animal Losses	Mold Losses	Long Drying Period	High Cost
Rice	17	83	83	79	54	78	48	74	0
Coffee	4	90	79	22	63	65	68	92	18
Cacao	15	90	92	53	70	78	68	88	4
Groundnuts	10	97	87	23	43	60	40	70	13
Sorghum	7	33	7	37	27	37	3	27	7
Beans	23	89	62	42	89	89	85	85	12
Maize	24	80	68	4	84	88	76	60	24
Sesame Seeds	0	55	81	73	36	82	46	72	0
Ginger	-	90	80	60	100	80	90	80	10
Pepper	-	56	44	-	77	56	44	100	-
Millet	-	100	43	14	86	100	71	57	29

TABLE 3: Percentage of farmers, for each crop, expressing advantages and disadvantages of drying over fire

Crop	ADVANTAGES				DISADVANTAGES					
	Fast Drying	Good Quality	Dry large Quantities	Cost Low	Insect Infestation	Rain, Wind Animal Losses	Mold Losses	Long Drying Period	Crop Burns	High Cost
Rice	19	25	20	0	4	5	4	9	18	15
Coffee	-	-	-	-	-	-	-	-	-	-
Groundnuts	17	27	30	7	3	7	3	20	40	7
Sorghum	0	3	10	10	10	3	10	7	13	13
Beans	27	8	8	-	12	4	4	8	4	4
Maize	4	12	-	-	16	12	4	28	20	16
Pepper	11	-	11	-	-	11	11	33	11	-
Sesame Seeds	55	0	0	-	-	-	-	-	55	0
Ginger	-	20	-	-	10	-	-	-	20	-
Millet	-	14	14	-	14	14	0	14	14	14

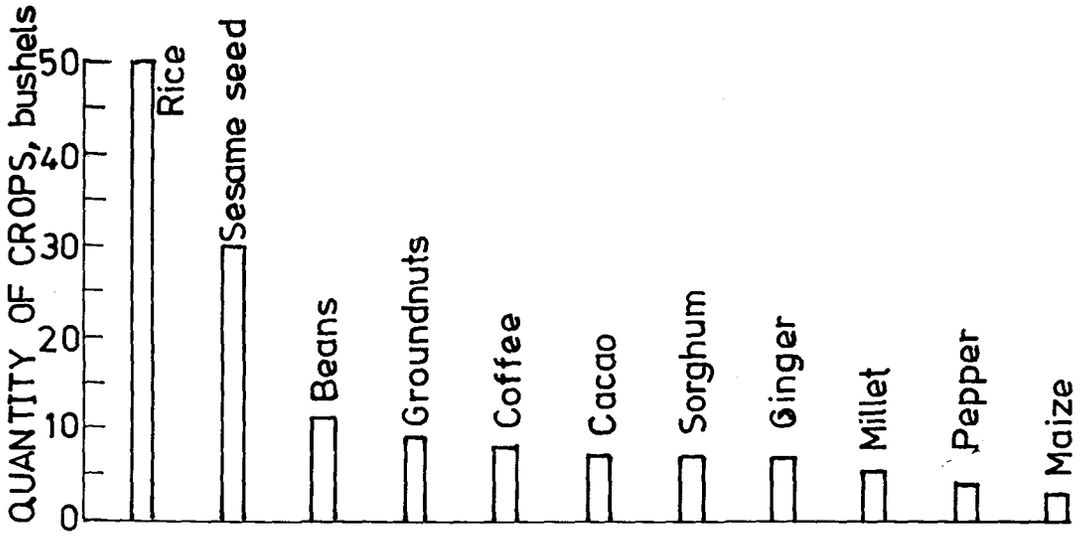

Figure 7. Maximum possible post harvest drying losses as perceived by farmers.

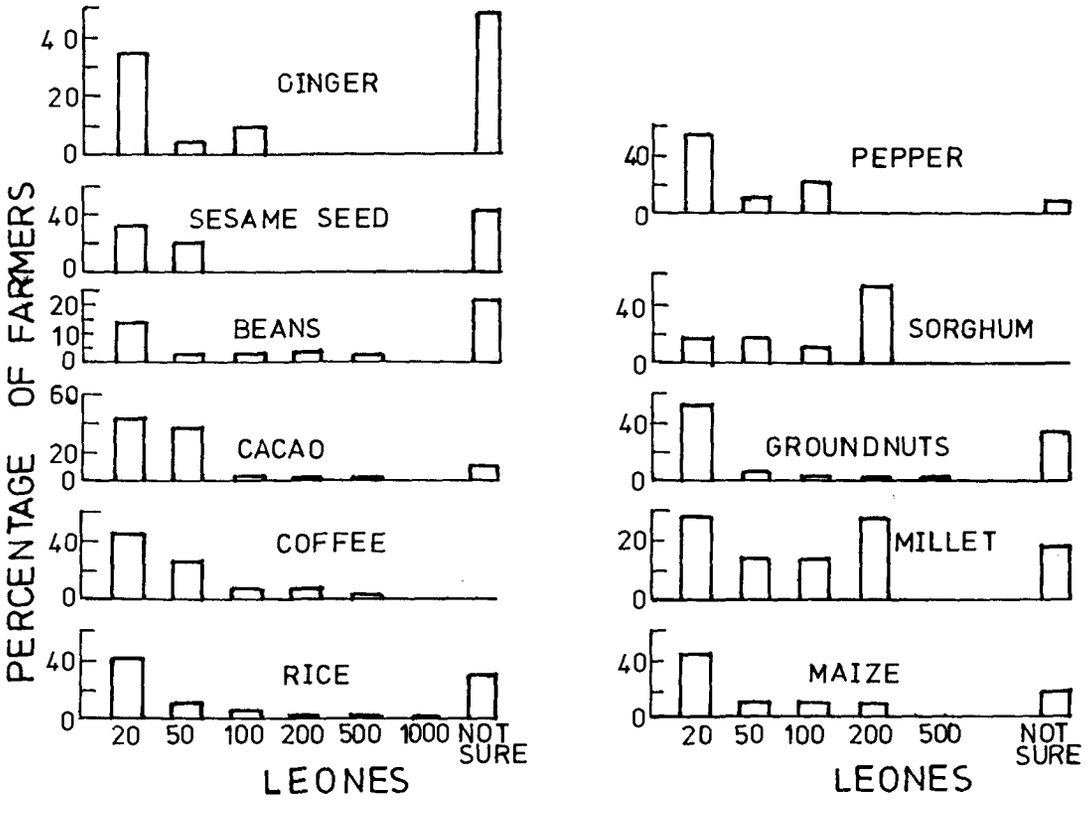

Figure 8. Percentage of farmers, of the total for each crop, willing to pay certain amounts for a dryer.

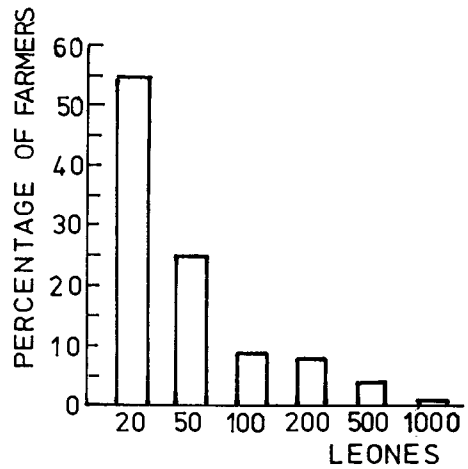

Figure 9. Percentage of farmers for all crops willing to pay certain amounts for a dryer.

uncertainty by farmers to pay for improvements may be because ginger drying is not viewed as a significant problem.

Table 4. Percentage of farmers using crops for home use and sale.

Crops	Consumption	Sale
Rice	66	33
Coffee	12	88
Cacao	5	95
Beans	41	59
Sesame Seeds	50	50
Ginger	9	91
Pepper	47	53
Sorghum	50	50
Groundnuts	39	61
Millet	50	50
Maize	44	51

Importance of Results for Development of Improved Dryers

Results of this study indicate that farmers generally wish to improve traditional inorder to handle larger quantities of crops and to decrease losses. Rice ranks highest as the crop which needs drying, but other crops could play an important role in the economic viability of improved drying systems since more than one crop is often grown on the same farm. Cash crops such as rice, cacao, coffee, ginger, groundnuts, peppers and beans, could be important target crops for use in a dryer. Dryers developed would, in view of the diverse nature of the crops, have to be capable of being used on various crops and would need to be of the direct or indirect type, considering the temperature requirements of various crops.

Due to the low income of farmers and the lack of electricity to power fans, dryers must be of the natural flow type. They must be able to withstand humid conditions such as that existing during the rainy season. In addition, their construction should be of cheap, locally available materials and farmers should be able to construct and repair them. The range of quantities to be dried suggests that dryers introduced should be modular in design inorder to cater for the needs of a wide cross section of users.

Solar dryers must effectively compete with traditional drying methods. Farmers will have to be convinced of the actual drying times of mature crops after harvest. It will be necessary to compare the drying times of both methods showing the benefits of, e.g., harvesting early and using the dryer to minimize losses and improve product quality.

CONCLUSIONS

The following conclusions can be made from this study:

1. Traditional open air drying is the dominant method being used to dry crops in Sierra Leone.
2. Crops which need drying include rice, coffee, cacao, groundnuts, sorghum, beans, maize, ginger, sesame seeds and pepper.
3. A significant number of crops are dried during the rainy season when the risk of substantial losses is high.
4. Quantities of crops dried vary widely and depend on the income level of the farmer.

5. Improved dryers should, in view of the different types and quantities of crops which need to be dried, be modular in nature and of the direct or indirect natural convection type.
6. Effectively all farmers would like to improve their drying methods in order to improve drying time, minimize losses and handle more crops.
7. Eighty percent of farmers are willing to pay for improved drying systems, but only about 45% of those willing to pay can afford solar dryers.
8. Farmers will have to be convinced of the effectiveness of improved drying methods since some of their opinions about drying, e.g., drying times, are quite subjective.
9. Solar dryers for rural use should be constructed from cheap but durable local materials in order to minimize costs and increase the chances for their adoption.

ACKNOWLEDGEMENTS

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